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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/691,957	10/23/2003	Joseph B. Seale	03-040	6316

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EXAMINER	
ROMAN, LUIS ENRIQUE	

ART UNIT	PAPER NUMBER
2836	

DATE MAILED: 02/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/691,957	SEALE ET AL.	
	Examiner	Art Unit	
	Luis Roman	2836	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *28-37* is/are allowed.

6)☒ Claim(s) *1-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10/26/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claim 15 is objected to because of the following informalities: there are two limitations referred as **a)**.
Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 2, 7, 10 & 11 are rejected under 35 U.S.C. §103(a) as being unpatentable over Wright et al. (US 6657847) in view of Ito (US 6634248).

Regarding claim 1 Wright et al. discloses a system for solenoid control to achieve low impact landing with latching under varying conditions, comprising: a) sense means (col. 2 lines 37-38), for obtaining parameters indicating the state of a controlled solenoid, b) path memory means (col. 6 lines 66-67), for retrieval of information descriptive of paths in a state space (Fig. 3A & 3B), said paths approximating possible paths in a state space of said controlled solenoid, including a multiplicity of paths that lead to low impact landings (Fig. 12 elements 130 & 132) with latching under a corresponding multiplicity of operating conditions; c) error detection means (col.13 lines 4-9 & Fig. 12 elements 133 & 136), for comparing said information from said path memory means with said parameters from said sense means, thereby defining an error between said state of said controlled solenoid and a state in said state space corresponding to one of said multiplicity of paths that lead to low impact landings with latching.
Wright et al. does not disclose d) drive control means setting an output signal in accordance with information from said sense means, said path memory means, and said error detection means; whereby the dynamically changing state of said controlled solenoid is caused to approach a path among said multiplicity of paths that lead to low impact landings with latching. Moreover, it is not disclosed the solenoid with latching.
Ito teaches d) drive control means (col. 1 lines 27-29) setting an output signal in accordance with information from said sense means, said path memory means, and said error detection means; whereby the dynamically changing state of said controlled solenoid is caused to approach a path among said multiplicity of paths that lead to low impact landings with latching (col. 1 lines 38-42).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Wright et al. device with the Ito device features since a control unit can perform many operations with the sensed signals comparing them with preset values stored in memory and taking action accordingly, adding the solenoid with latching will provide improvements since this feature will assure the locking of the solenoid on one state till gets a control signal to change that state.

Regarding claim 2 Wright et al. in view of Ito discloses the system of claim 1. Wright et al. further discloses wherein said parameters from said sense means are transformable into an indicator of position (col. 3 lines 46-51), an indicator of velocity (col. 3 lines 46-51), and an indicator of electromagnetic state (col. 7 lines 25-30).

Regarding claim 7 Wright et al. in view of Ito discloses the system of claim 1. Wright et al. further discloses wherein said parameters from said sense means include a measured current (Fig. 5 element 54), a voltage (Fig. 5 element 50), and a flux linkage (Fig. 5 element 66) inferred from integration (Fig. 5 element 64) of an inductive voltage (Fig. 5 output of element 60) related to said voltage and said measured current.

Regarding claim 10 Wright et al. in view of Ito discloses the system of claim 7. Wright et al. further discloses wherein said current and said flux linkage together indicates position of said solenoid (col. 3 lines 46-51).

Regarding claim 11 Wright et al. in view of Ito discloses the system of claim 10. Wright et al. further discloses wherein differences in said position at different times provide a measure of velocity, whereby the state of said solenoid is defined by said position, said measure of velocity, and said flux linkage (col. 6 lines 1-17).

Claims 3, 4, 5, 6, 8 & 9 are rejected under 35 U.S.C. §103(a) as being unpatentable over Wright et al. (US 6657847) in view of Ito (US 6634248) and Seale et al. (US 6208497).

Regarding claim 3 Wright et al. in view of Ito discloses the system of claim 2. Wright et al. in view of Ito does not disclose wherein said indicator of velocity is a difference between two positions.
Seale et al. further teaches wherein said indicator of velocity is a difference between two positions (col. 40 lines 61-64).
It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Wright et al. and Ito device with the Seale et al. device features as can be appreciated by those skilled in the art, it is desirable to closely balance the spring force on the armature with the magnetic forces acting on the armature in the region near the stator core so as to achieve "low impact landing" of the armature against the stator core. In order to obtain a low impact landing of the armature against the stator core, power to the coil may be modulated to reduce the armature velocity as the armature approaches the stator core in the second position.

Regarding claim 4 Wright et al. in view of Ito discloses the system of claim 2. Seale et al. further teaches wherein said indicator of electromagnetic state is flux linkage (col. 11 lines 54-58).

Regarding claim 5 Wright et al. in view of Ito discloses the system of claim 2. Seale et al. further teaches wherein said indicator of electromagnetic state is current (col. 12 lines 6-7).

Regarding claim 6 Wright et al. in view of Ito discloses the system of claim 1. Seale et al. further discloses wherein said output signal from said drive control means is a voltage (abstract).

Regarding claim 8 Wright et al. in view of Ito discloses the system of claim 1. Seale et al. further discloses wherein said voltage is inferred from said setting of said output signal by said drive control means (abstract).

Regarding claim 9 Wright et al. in view of Ito discloses the system of claim 7. Seale et al. further discloses wherein said voltage is inferred from a pulse width modulation duty cycle and knowledge of a supply voltage (col. 36 lines 66-67).

Claims 12, 13 & 14 are rejected under 35 U.S.C. §103(a) as being unpatentable over Wright et al. (US 6657847) in view of Ito (US 6634248) and Osborn et al. (US 6366199).

Regarding claim 12 Wright et al. in view of Ito discloses the system of claim 1. Wright et al. further discloses wherein: a) said one of said multiplicity of paths that lead to low impact landings with latching is associated with a particular operating condition from among said multiplicity of operating conditions (Fig. 3A & Fig. 3B); b) said particular operating condition is a mechanical energy of said solenoid (Fig. 3A decision block bottom right); c) said particular operating condition is associated with a path number (the software will select the appropriate path for sensed conditions, which are ordered with a certain pattern/number).
Wright et al. in view of Ito does not disclose d) said drive control meaning includes means to quantify systematic drift in said path number; and e) said systematic drift indicates an error in said information from said path memory means that is accessed by said error detection means for said comparing and said defining an error.
Osborn et al. teaches d) said drive control meaning includes means to quantify systematic drift in said path number (col. 2 lines 21-52); and e) said systematic drift indicates an error in said information from said path memory means that is accessed by said error detection means for said comparing and said defining an error (col. 3 lines 7-19).
It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Wright et al. and Ito device with the Osborn et al. device features in order to provide the method with a complete database with information on

the physical variables of various devices to take part in the processes of controlling said devices.

Regarding claim 13 Wright et al. in view of Ito and Osborn et al. discloses the system of claim 12.
Wright et al. further discloses wherein said error in said information is used to correct said information descriptive of paths retrieved by said path memory means (Fig. 3B bottom 2 blocks).

Regarding claim 14 Wright et al. in view of Ito and Osborn et al. discloses the system of claim 12.
Osborn et al. further discloses wherein said error in said information is used to select and retrieve different information descriptive of paths from said path memory means, whereby said different information is selected to better match predictive path perturbations which are affecting approach to said low impact landing which are distinct from said operating conditions, and which describe a present mechanical energy arising from past events (col. 3 lines 7-19).

Claims 15 & 17 are rejected under 35 U.S.C. §103(a) as being unpatentable over Haghgooic et al. (US 6681728) in view of Ito (US 6634248).

Regarding claim 15 Haghgooic et al. discloses a method for solenoid control to achieve low-impact landing, including steps of:
a) testing, wherein a test system (col. 5 lines 22-26), having response characteristics like those of the solenoid to be controlled is caused to execute trajectories (col. 2 lines 6-14 <US 6196172; col. 10 lines 1-10>), including trajectories with differing initial energies that achieve low-impact landing (abstract).
b) path function calibration, wherein parameters of path functions are adjusted so that said path functions describe said trajectories that achieve said low-impact landing (col. 5 lines 29-36);
c) calibration programming, wherein a real-time solenoid hardware controller is programmed to recall said path function calibration (col. 6 lines 12-21 & Fig. 5);
d) response comparison programming, wherein said controller is further programmed to make a comparison between a measured solenoid response and at least one of said trajectories described by said path functions (col. 2 lines 6-14 <US 6196172; Fig. 2>), and
e) drive control programming, responsive to said comparison by controlling an electrical drive signal as part of the actuation of said measured solenoid (col. 6 lines 39-47 & Fig. 7 element 90).
Haghgooic et al. does not disclose said low-impact landing including latching and no speed of impact or of bounce-and-impact exceeding a prescribed maximum speed;
Ito teaches said low-impact landing including latching and no speed of impact or of bounce-and-impact exceeding a prescribed maximum speed (col. 1 lines 38-42).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Haghgooic et al. device with the Ito device features since a control unit can perform many operations with the sensed signals comparing them with preset values stored in memory and taking action accordingly adding the solenoid with latching will provide improvements since this feature will assure the locking of the solenoid on one state till gets a control signal to change that state.

Regarding claim 17 Haghgooic et al. in view of Ito discloses the method of claim 15.
Haghgooic et al. further discloses wherein said test system is a solenoid with instrumentation to measure said trajectories (col. 2 lines 6-14 <US 6196172; col. 7 lines 43-52>).

Claims 16, 18, 19, 20, 21, 22, 24, & 25 are rejected under 35 U.S.C. §103(a) as being unpatentable over Haghgooic et al. (US 6681728) in view of Ito (US 6634248) and Wright et al. (US 6657847).

Regarding claim 16 Haghgooic et al. in view of Ito discloses the method of claim 15.
Haghgooic et al. in view of Ito does not disclose wherein said test system is a mathematical simulation generating simulated response characteristics equivalent to said response characteristics like those of the solenoid to be controlled.
Wright et al. teaches wherein said test system is a mathematical simulation generating simulated response characteristics equivalent to said response characteristics like those of the solenoid to be controlled (col. 11 lines 63-67 & col. 12 lines 1-15).
It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Haghgooic et al. and Ito device with the Wright et al. device features to obtain a high-speed control system and method for an electromagnetic actuator capable of detecting and compensating for the non-ideal conditions during each stroke of the armature.

Regarding claim 18 Haghgooic et al. in view of Ito discloses the method of claim 15.
Wright et al. further teaches wherein said path functions define points in a multi-dimensional space of state space variables (col. 2 lines 66-67 & col. 3 lines 1-9).

Regarding claim 19 Haghgooic et al. in view of Ito discloses the method of claim 18.
Wright et al. further teaches wherein the dimensions of said space are transformable into the dimensions of position (col. 3 lines 46-51), velocity (col. 3 lines 46-51), and flux linkage (col. 7 lines 25-30).

Regarding claim 20 Haghgooic et al. in view of Ito discloses the method of claim 18.
Wright et al. further teaches wherein said dimensions are a measured position, a difference between measured positions, and a cumulative total of inductive voltages (col. 6 lines 1-17).

Regarding claim 21 Haghgooic et al. in view of Ito discloses the method of claim 20.
Wright et al. further teaches wherein said inductive voltages are voltages measured from a sense coil (col. 2 lines 37-38).

Regarding claim 22 Haghgooic et al. in view of Ito discloses the method of claim 20.
Wright et al. further teaches wherein said inductive voltages are computed from an applied voltage (Fig. 5 element 50), a current, (Fig. 5 element 54) and a resistive voltage (Fig. 5 element 52) that is a function of said current.

Regarding claim 24 Haghgooic et al. in view of Ito discloses the method of claim 22.
Wright et al. further teaches wherein said current is measured using a sense resistor (Fig. 5 element 52).

Regarding claim 25 Haghgooic et al. in view of Ito discloses the method of claim 22.
Wright et al. further teaches wherein said resistive voltage function is said current multiplied by a resistance (col. 7 lines 20-23 & Fig. 5 elements 52, 56).

Claims 26 & 27 are rejected under 35 U.S.C. §103(a) as being unpatentable over Haghgooic et al. (US 6681728) in view of Ito (US 6634248) and Seale et al. (US 6208497).

Regarding claim 26 Haghgooic et al. in view of Ito discloses the method of claim 15.
Haghgooic et al. in view of Ito does not disclose wherein said drive control programming includes determination of a flux linkage projected into the future relative to a measurement time of said measured solenoid response.
Seale et al. teaches wherein said drive control programming includes determination of a flux linkage projected into the future relative to a measurement time of said measured solenoid response (col. 48 lines 35-48).
It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Haghgooic et al. and Ito device with the Seale et al. device features as can be appreciated by those skilled in the art, it is desirable to closely balance the spring force on the armature with the magnetic forces acting on the armature in the region near the stator core so as to achieve "low impact landing" of the armature against the stator core. In order to obtain a low impact landing of the armature

against the stator core, power to the coil may be modulated to reduce the armature velocity as the armature approaches the stator core in the second position.

Regarding claim 27 Haghgooic et al. in view of Ito discloses the method of claim 15.
Seale et al. further teaches wherein said drive control programming includes determination of a voltage to be generated in a future period of time relative to a measurement time of said measured solenoid response (col. 48 lines 35-48)..

Claim 23 is rejected under 35 U.S.C. §103(a) as being unpatentable over Haghgooic et al. (US 6681728) in view of Ito (US 6634248), Wright et al. (US 6657847) and Seale et al. (US 6208497).

Regarding claim 23 Haghgooic et al. in view of Ito and Wright et al. discloses the method of claim 22.
Haghgooic et al. in view of Ito and Wright et al. does not disclose wherein said applied voltage is computed from supply voltage information and from the duty cycle of a pulse width modulator.
Seale et al. teaches wherein said applied voltage is computed from supply voltage information and from the duty cycle of a pulse width modulator (col. 36 lines 66-67).
It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Haghgooic et al., Ito and Wright et al. device with the Seale et al. device features as can be appreciated by those skilled in the art, it is desirable to closely balance the spring force on the armature with the magnetic forces acting on the armature in the region near the stator core so as to achieve "low impact landing" of the armature against the stator core. In order to obtain a low impact landing of the armature against the stator core, power to the coil may be modulated to reduce the armature velocity as the armature approaches the stator core in the second position.

Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claims 28-36, they are of allowable subject matter because prior art of record either alone or in combination does not teach or fairly suggest and adaptive system for solenoid control that includes all the plurality of steps recited in the claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luis E. Román whose telephone number is (571) 272 – 5527. The examiner can normally be reached on Mon – Fri from 7:15 AM to 3:45 PM.
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Sircus can be reached on (571) 272-2800 x 36. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.
Information regarding the status of an application may be obtained from Patent Application Information Retrieval (PAIR) system.
Status information for unpublished applications is available through private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Luis E. Román
Patent Examiner
Art Unit 2836

LR/111705

Stephen W. Jackson
1-25-06

STEPHEN W. JACKSON
PRIMARY EXAMINER